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(19) (CA) **CANADIAN PATENT** (12)

(54) Hockey Stick

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#### ABSTRACT OF THE DISCLOSURE

A hockey stick for goalkeepers is covered with aramid fibre containing fabric impregnated by an epoxy resin, at its blade portion and a part of the widened shaft portion immediately, obliquely, upwardly of the blade portion. In an alternate embodiment, the blade is formed of two parallel extending laminations separated by a middle layer of aramid fibre containing fabric and resin, and their outer surfaces are entirely covered with similar exterior layers, thereby giving the hockey stick great strength, damping qualities and resistance to shock or cutting while still being lightweight and balanced.

FIELD OF THE INVENTION

This invention relates to sports equipment, more specifically to an improved hockey stick for goalkeepers and a method of producing the same.

BACKGROUND OF THE INVENTION

The modified hockey stick used by goalkeepers is a sports item that has one of the shortest lifespans among similar articles used in contact sports. As is known, a goalkeeper's stick has a wider, longer and thicker blade and a widened shaft portion as compared to the sticks used by defencemen and forwards. There are two reasons for this fact: 1) to better protect the goal; 2) to be strong enough to resist more than a few slapshots.

Despite the fact that the blade of a goalie stick is wider and thicker than that of a forward stick, it still lasts much less than the regular sticks as it has to resist the impact of shots by players of professional caliber who are able to unleash wrist shots as well as slap shots which have not uncommonly been clocked at velocities of 80 m.p.h. or more. When a puck travelling at such speeds hits the goalkeeper's stick it is readily understandable that the latter deteriorates rather quickly during a practice session or a game.

Most goalkeeper's sticks in use today are made of a resistant hardwood such as ash, the blade portion of which is coated by a thermosetting resin reinforced by a fabric of glass fibres. Or, alternatively, a goalkeeper's stick can be made of synthetic material such as a suitable hollow core of plastic again coated by glass fibre reinforced resin material at the blade portion. As noted above, one important disadvantage of such state-of-the-art goalkeeper's sticks is that they are subject to splintering, fracture or weakening after a relatively short period of time or, in the case of hollow-core plastic sticks, are very expensive. In fact, it has been found in on-ice trials that such a goalkeeper's stick cannot withstand more than approximately ten slap



shots without damage thereto.

Thus, one important characteristic of a goalkeeper's hockey stick - that of strength and durability - remains unsatisfied by presently available sticks.

10 The prior art has attempted to provide for a stronger stick, usually by varying the orientation and assembly of the blade portion laminations and/or coating the wood or plastic of the blade portion with glass fibre impregnated with resin such as polyester or epoxy. For example, the Canadian Patent issued to Harwell on January 4, 1983 and bearing number 1,138,912 teaches a standard defenceman or forward stick having a blade portion which is fitted with a braided tubular sleeve. The sleeve is stretched to closely adhere to the blade portion even if the latter is curved and is then impregnated with a curable resin material. However, this Patent is directed to hockey sticks in general rather than specifically to a goalkeeper's stick.

As shall presently be shown there are important differences between the two types of hockey sticks.

20 It is indeed striking that the prior art has failed, till now, to take into account the different characteristics needed for a goalkeeper's stick. One has been noted above: strength and durability, which are essential not only for economic reasons. For instance, when the action around the goalie's net becomes furious and a hard shot happens to break or badly damage the goalie's stick, the goalie is not allowed to change stick until one of the umpires calls it off for another reason therefore, a goal, even a game-winning goal, can be scored against the handicapped goalie. Other situations will come readily to mind. Another important fact the prior art consistently fails to consider is that the rear surface of the blade portion of the goalkeeper's stick abuts against the forward edges of the goalkeeper's skates. Thus, each time  
30 the blade of the stick stops a hard shot the stick is impacted against the skates, causing indentations in the blade which progressively cut

deeper, weakening the entire blade, as every goalkeeper, professional or amateur knows.

The other important differences can be summarized as follows:

Balance. The goalie's stick, even while having a wider blade portion, must remain light so that the center of gravity of the stick remains located upwardly of the blade. This is important because, contrary to a forward or defenceman, the goalkeeper holds his stick, most of the time, by only one hand to leave his glove hand free. Moreover, the goalie frequently holds his stick above the ice. Thus, a balanced stick having a center of gravity located approximately ten inches from the hand that holds the stick is necessary to prevent wrist fatigue and also to make the stick easily movable. The heavier the blade portion the more undesirable it is. Therefore, when the blade is strengthened by known methods, materials balance is sacrificed in favor of greater strength.

Damping quality. For a hockey stick, damping may be defined as the capacity of the stick, especially the blade portion, to absorb and dissipate the energy produced by the impact a puck makes thereon. Wood, protected or not by a coating of epoxy resin reinforced with glass fibres, is the most commonly used material for hockey sticks because it absorbs impact fairly well, is stiff, is of low density compared to plastics or composite materials, is inexpensive, is readily workable and is resilient. All of these properties make it the ideal material for the stick of a forward or defenceman. For example, resiliency is a trump characteristic because a resilient handle and lower shaft portion allows the player to "sweep" the ice with the blade portion before contacting the puck in a slap shot. It has been estimated that approximately 50% of the energy imparted to a slap shot puck derives from the bending of the shaft of the stick when the blade portion sweeps the ice.

However, a goalie never makes slap shots. Moreover, the good

damping quality of wood is not great enough to entirely eliminate the vibration in the stick caused by a hard shot. The vibration travels up the shaft of the stick and through the arm of the goalkeeper. This can be very uncomfortable for the goalie especially during a practice session during which he has to receive dozens, even hundreds of shots. Canadian Patent issued to Hilton S. Staats on July 20, 1982 and bearing number 1,128,088 has attempted to indirectly overcome this problem by providing a goalkeeper's stick characterized by a mesh formation made in a perimeter frame portion of the blade and also in the widened portion of the shaft. This mesh will certainly absorb most of the energy of the puck without excessive vibration but the goalkeeper becomes unable to direct a rebound from a shot to one of his own players or to a clear area of the ice when the opposition players are in threatening positions.

To recapitulate briefly the foregoing discussion, it is clear that a goalkeeper's hockey stick must: 1) be stronger than the stick of a forward line player or a defenceman; 2) it must be balanced, therefore needing a blade portion as light as possible; and 3) it must have good damping quality to quickly absorb energy and to reduce as much as possible vibration which is both undesirable in itself and also weakens the stick over a period of time.

#### OBJECTS OF THE INVENTION

Accordingly, it is the prime object of the present invention to provide a hockey stick for goalkeepers having all of the above-discussed positive characteristics.

It is also an object of the present invention to provide a hockey stick of the type described which is easy and inexpensive to manufacture.

#### SUMMARY OF THE INVENTION

The above and other objects of the present invention are realized according to a preferred embodiment comprising a standard goalkeeper's hockey stick composed of a widened and elongated blade portion

and a shaft having another widened portion immediately upwardly of the blade portion and obliquely inclined to the latter.

The stick may be made of a suitable hardwood.

According to a first embodiment of the invention, the blade portion and preferably also the widened portion of the shaft, are covered with a fabric containing at least 20% by weight of organic aramid fibres such as the fibres known under the trade mark of KEVLAR of DuPont of Canada Inc. The fabric is embedded in a thermosetting resin which is bonded to the material of the stick in the known manner of fabrication.

10 According to an alternative embodiment, a pair of parallel-extending blade laminations are separated by a middle layer of KEVLAR-containing fabric and the same type of fabric covers the outside faces of the blade.

The novel and unique application of aramid fibre containing-fabric to the hockey stick of a goalkeeper gives entirely unforeseen and unexpected results as will be explained below.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above will be fully understood by having reference to the preferred embodiment of the invention, illustrated by the annexed drawings, in which:

Figure 1 is a side elevation of the lower portion of a goalkeeper's hockey stick coated with aramid fibre-containing fabric;

Figure 2 is a sectional view taken along line 2-2 of Figure 1; and

Figure 3 is a view similar to that of Figure 2 showing the alternate embodiment of the invention.

Like numerals indicate like elements throughout the drawings.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

30 Figure 1 depicts the lower portion of a goalkeeper's hockey stick 10 including a wide elongated blade 14, a shaft 16 and a widened shaft portion 12. The blade 14 has a forward edge 22, a lower edge 23

an upper edge 20, a heel area 24 and a throat 25. Blade 14 and portion 12 are preferably made of a hard wood, such as ash, although plastic can also be used.

To comply with the official rules of the National Hockey League, a goal-keeper hockey stick must have specified maximum dimensions and, in practice, therefore, the goal-keeper hockey stick 10 in accordance with the present invention has the following range of dimensions for its pertinent parts.

10 The widened shaft portion 12 has a length varying between 23 and 26 inches from the heel 24 up along the shaft 16; and a width varying between 3.2 and 3.5 inches. The blade 14 has a length from the heel to the blade tip varying between 13.9 and 15.5 inches. The blade 14 has a width varying between 3.2 and 3.5 inches.

Blade 14 and an area of shaft portion 12 up to about line 15 are covered with an aramid fibre-containing layer 32, 33 on both sides thereof, respectively. The upper edge 20 and the throat 25 may not be coated but heel area 24 and lower edge 23 are coated to prevent wear in contact with the ice. The entire area of widened shaft portion may be coated with layer 32, 33 and lower edge 23 with layer 43.

20 Figure 3 shows the alternate embodiment, comprising two parallel blade laminations 34, 36 separated by a middle layer 42 also containing aramid fibres. In this embodiment, both outer surfaces and both upper and lower edges are also coated with aramid fibre-containing layers 38 and 40 and 41 and 43, respectively.

Layers 32, 33, 38, 40, 42, and 43 each consist of a woven fabric impregnated with a thermosetting resin, such as epoxy, which also bonds the layers to the wood.

30 The fabric is composed of woven warp and weft slivers, each containing several fibres. The weight per unit surface of the fabric may vary between 1.7 and 8 ounces per square yard and is preferably 5 ounces per square yard. The thickness of the fabric is about 0.01".



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The fabric contains aramid fibres, such as the fibres marketed under the trade mark KEVLAR. Both KEVLAR types 29 and 49 are suitable, although type 49 is preferred.

The fabric slivers preferably consist of 100% KEVLAR fibres for maximum resistance of the blade to breakage.

However, for reasons of economy, the KEVLAR slivers may be adjoined to slivers of glass fibres: resistance of the blade is decreased but still has an acceptable value. Such a fabric, when of a density of 5 ounces per square yard, contains a minimum of 40% of KEVLAR fibres by weight.

10

Slivers of KEVLAR may alternate with slivers of glass fibres in both the weft and the warp of the fabric.

Alternately, the slivers of KEVLAR may form the entire weft or the entire warp and vice versa for the slivers of glass fibres. The fabric may also contain a maximum of 25% by weight of carbon fibres in order to increase the rigidity of the blade.

Several comparative tests were made by hockey players using similar sets of goalkeeper sticks, one set consisting of conventional ash sticks reinforced by a 5.5 ounces fabric solely of glass fibres and the  
10 other set consisting of ash sticks made in accordance with Figures 1 and 2 and reinforced with 5 ounces fabric solely of KEVLAR 49 fibres.

It was found that the sticks of the invention withstand between 30 and 50 slapshots before breaking as compared to 5 to 10 slapshots for the conventional sticks.

This great improvement could not be foreseen considering that the blade of such sticks contains about 90% wood by weight and that the conventional mechanical properties of KEVLAR 49 and glass fibres are quite similar (see in this connection the magazine "Plastiques modernes et élastomères" of December 1977, page 54, table 4).

20 The improvement can now be explained by the considerably greater damping factor of KEVLAR 49 fibres with epoxy resin compared to the damping factor of glass fibres with epoxy resin as shown in Table 5 of the same reference.

The blade of Figure 3 should last still longer than that of Figure 2.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED, ARE DEFINED AS FOLLOWS:

1. A goal-keeper hockey stick comprising an elongated blade having a heel and a tip; a shaft rigidly connected to said blade in the area of said heel and having a widened shaft portion adjacent said blade located immediately obliquely upwardly therefrom; said widened shaft portion having a length from said heel up along said shaft, between 23 and 26 inches and a width varying between 3.2 and 3.5 inches, the length of said blade from said heel to said tip varying between 13.9 and 15.5 inches and the width of said blade varying between 3.2 and 3.5 inches; a layer of thermosetting resin covering said blade; a woven fabric embedded in said layer, said fabric having a weight per unit surface varying between 1.7 and 8 ounces per square yard; and aramid fibres embedded in said layer and forming at least 40% by weight of said woven fabric.

2. A goal-keeper hockey stick as claimed in claim 1, wherein said fabric has a weight per unit surface of 5 ounces per square yard.

3. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein the remainder of said fabric is glass fibres.

4. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein the remainder of said fabric comprises glass fibres and carbon fibres, the latter forming a maximum of 25% by weight of the fabric.

5. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein said fabric is entirely made of aramid fibres marketed under the trade mark KEVLAR.

6. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein said fabric is entirely made of aramid fibres marketed

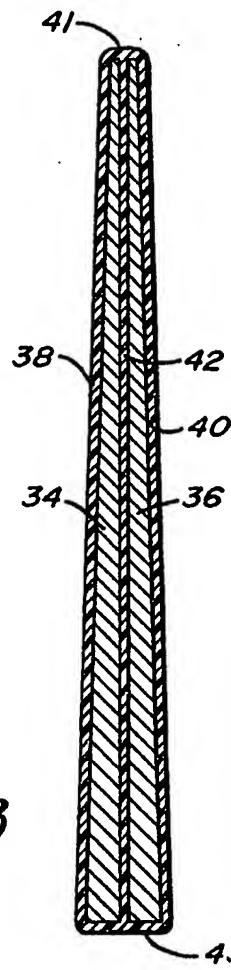
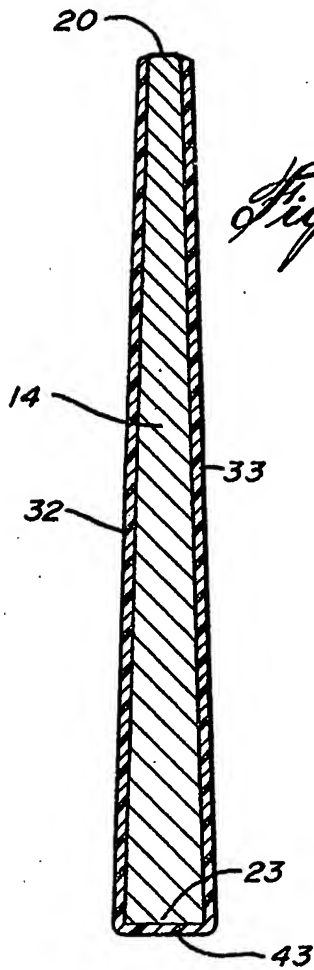
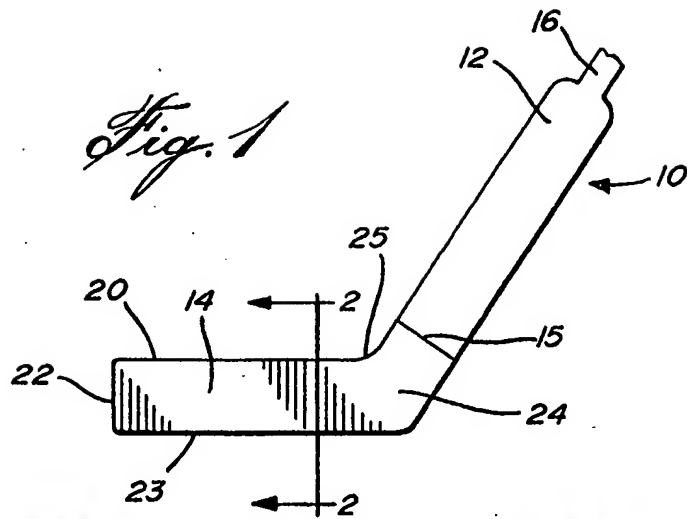
under the trade mark KEVLAR, type 49

7. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein said layer covers also said widened shaft portion over at least its part adjacent said blade.

8. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein said blade is made of hardwood.

9. A goal-keeper hockey stick as claimed in claim 1 or 2, wherein said blade consists of at least two parallel longitudinally-extending laminations made of hardwood and an additional layer of thermosetting resin extending between each two laminations adhering the same to each other and said woven fabric also embedded in said additional layer.





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